

Lesson 5



Farm

Down on the Farm

There are billions of people to feed on this planet; although students may not know it, their diet depends on the work of decomposers. In order for students to grasp how dependent humans are on decomposers, they must understand the connection between productive agriculture and the organic content of soils. Almost all the plant matter humans eat traces back to the topsoil in which it was grown.

In Lesson 5, students encounter the term “humus” and learn how decomposers form humus. Through discussion, they discover how decomposers and the humus they produce influence the fertility of topsoil.

Students work with a partner to analyze different soil samples and determine which sample they think is best suited for growing crops. Finally, students participate in a demonstration that illustrates the limited

amount of topsoil available on Earth for agriculture. They apply what they learn from the demonstration to describe the importance of decomposers to our agricultural systems.

Learning Objective

Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management).

Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal, and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).



organisms and releasing nutrients into the soil.

Fertile soil tends to be dark, damp, and rich in humus. Humus helps minerals bond together, creating small spaces in between particles so the soil will retain water and release it slowly. Because humus itself does not stick together well, it helps to loosen the soil, allowing air to move freely to decomposers and plant roots. Sandy soils like those found in deserts tend to be light brown and dry; contain loose, large particles; and drain water quickly. While desert plants are adapted to these soil conditions, many of our food plants are not and this soil cannot be used for agriculture. Soils with high clay content contain small particles that are densely compacted, so they hold water tightly, making accessing the water difficult for plant roots. The most fertile soils contain moderate to high levels of humus, which is a direct link to the health of the vegetation growing there. For this reason, decomposers and the humus they produce are essential to sustaining long-term agriculture practices without the use of chemical fertilizers.

Background

For organisms to proceed through life cycles, they need nutrients. When living organisms die, the nutrients that sustained their lives are still of use. In order for these nutrients to be available for use again, however, they must somehow return to the natural system in elemental form.

Topsoil is the upper layer of soil, characterized by a higher content of organic matter. Due to geography, weather conditions, and urbanization, limited amounts of topsoil are suit-

able for agriculture. Not all topsoil is of the same quality. Topsoil found in a forest, garden, or desert will display different characteristics. These characteristics determine the soil's fertility. Ultimately, a soil's organic content, or humus, determines its particle size, color, and ability to absorb and retain water, and air. Humus is dark organic material in soil in the very last stage of decomposition. Humus forms as a byproduct of the work done by scavengers and decomposers breaking down dead



Sprouting plant

Key Vocabulary

Agriculture: The practice of growing crops and raising animals for food, fiber, or other use by humans.

Humus: The dark brown or black layer in soil that is made up of decaying plants and animal matter. Humus is rich in nutrients and helps hold water.

Topsoil: The upper layer of soil that contains organic matter that helps grow plants.

Toolbox



Summary of Activities

Students learn what humus is and that decomposers form humus as they break down dead organisms. They investigate different soil types and observe the amount of humus in topsoil. They apply their observations to describing why decomposers and humus are essential to agriculture.



Instructional Support

See Extensions & Unit Resources, page 30.

Prerequisite Knowledge



Students should be able to:

- explain that plants are the source of all foods.
- state that plants need water and nutrients to grow.
- record simple observations and data.

Advanced Preparation



Gather and prepare Activity Masters.

Gather and prepare Materials Needed:

- **My Decomposition Book**
- Place each soil type in an individual bucket. Write “A” on one index card and “B” on the other. Use tape to label the buckets as follows: The bucket containing sand should be labeled “A”; the bucket containing potting soil should be labeled “B.” Place buckets on the floor in a central place.

Gather and prepare Visual Aids:

- Prepare the photo cards of **Topsoil**, making one set for each pair of students.

Add to Word Wall.



Materials Needed



Activity supplies:

- Apple: One per class
- Buckets: Two per class, 1 gallon or bigger (see Advanced Preparation)
- Cups: One per student, at least 16 ounces
- Index cards: Two per class
- Knife: One per class, sharp
- Magnifying glass: One per student
- Measuring cups: Two ½-cup measuring cups (one per bucket)
- Paper towels: Two sheets per pair
- Potting soil: Ten cups of potting soil with high organic content.
- Sand: Ten cups of hygienic sandbox sand

Class supplies:

- Marker, pencils

Visual Aids



Photo cards:

- Topsoil, Visual Aid #11

Duration



Preparation Time

30 min.

Instructional Time

50 min.



Safety Notes

Be sure to keep the knife out of reach of students.

Activity Masters

No Activity Masters are required for this lesson.

Procedures

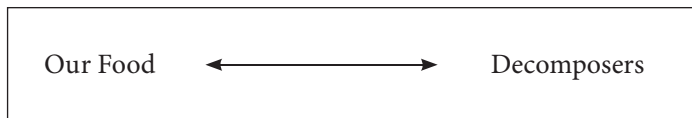
Vocabulary Development

Use the **Unit Dictionary** and the **Vocabulary Word Wall Cards** to introduce new words to students as appropriate. These documents are provided separately.

Step 1

Ask students, “Where does your food come from?” Take answers from several students. (*Answers will vary, but students should note that their food ultimately comes from plants.*) Ask another set of students, “What do plants need to grow?” (*Water, air [carbon dioxide], soil, and sunlight*) Ask a third set of students, “What is soil made of?” (*Organic materials and minerals*)

Draw the following diagram on the board:



Ask students to think about how decomposers connect to growing the food we eat.

Step 2

Distribute students’ copies of **My Decomposition Book**. Point out the three new words on the word list. Read over each word and its definition.

Have students locate “Agriculture,” “Humus,” and “Topsoil” on pages 1 and 2 of **My Decomposition Book** and copy the definitions there. Again, ask students to think about how decomposers connect to growing food.

Step 3

Hold up the apple and tell students that it represents Earth. Cut the apple into quarters, hold up three quarters, and explain that this portion of the apple represents the part of Earth’s surface that is covered by ocean water. Hold up the last quarter of the apple and explain that it represents the part of Earth that is not covered by ocean. Tell students that, on this small part of Earth, humans live, work, and grow their food.

Cut the quarter representing Earth’s land area in half. Hold up one of the one-eighth pieces, explaining that half of Earth’s land area not covered with ocean water has weather conditions so harsh that humans cannot live or grow food there. These are places like the North and South Poles, large deserts, and big swamps.

Hold up the other one-eighth portion of apple, telling students that this represents the part of Earth’s surface where people can live and where conditions make growing food possible.

Cut the one-eighth piece into four thin slices. Hold up all four of them, and tell the class that people *live* on this much of the Earth’s surface, but cannot grow food on all of it because:

- Some of this area has mountains and hills; the land is too steep to grow food. (Set down one of the four pieces.)
- Some of this area is already covered by our cities, houses, and roads; no room exists to grow food. (Set down another of the four pieces, leaving two.)
- Some of this area does not have soil for growing crops; it is too rocky. (Set down another of the four pieces, leaving one piece held up for students to see.)

Explain to students that this small piece of the whole apple shows how much of Earth’s surface is available for growing the food we need.

Carefully peel the skin off this thin slice of the apple, hold it up, and tell students that the tiny peel represents the topsoil available to farmers to grow crops in.



Step 4

Explain that topsoils are made of different materials including sand, clay, and humus. Tell students that topsoils containing lots of humus are very dark in color, smell earthy, and are crumbly. Good topsoil holds lots of water over a long period of time, so plants can use the water as they need it. It also is full of the nutrients that decomposers have released from dead animals and plants. Not all topsoil looks the same, but there are ways to tell what topsoil will help plants grow best.

Tell students they will be acting as teams of soil scientists examining two topsoil samples.

Step 5

Pair students and have the pairs sit together. Pass out the cups, magnifying glasses, paper towels, and a set of photo cards of **Topsoil** (Visual Aid #11) to each pair of students. Have students turn to page 12 in *My Decomposition Book*. Explain that this page provides instructions students will follow in their work as soil scientists.

Have each pair send up one representative to measure out one-half cup of soil from bucket A into one of their cups and take it back to their table. Have pairs work together to complete the questions for Sample A on page 12 of *My Decomposition Book*.

When a pair has completed the questions for Sample A, have the other student in the pair come up and measure out one-half cup of soil from bucket B into their other cup and take it back to their table. Have pairs again work together to complete the questions for Sample B on page 12 of *My Decomposition Book*.

Step 6

Call on students to share the properties of each soil observed by students. Take notes on the board, in T-chart form. (*Sample A is light tan, has large particles, is sandy and rocky, and smells salty, dusty, or sandy. Sample B is light, reddish brown, has pieces that look like sticks and hairs, feels wet and warm, and smells like dirt.*)

Have students think about what they observed and complete the three “Circle an Answer” and questions on page 12–13 of *My Decomposition Book*. Then tell the pairs to look carefully at the photo cards of **Topsoil**.

Step 7

Ask the pairs to hold up the card with the topsoil that is best for growing crops. Tell students that this would be the soil with the most humus. Ask students, “Which of your soil samples would be best for farming?” (*Sample B*) “Why?” (*Because it has the most humus, which means it has more nutrients and can hold more water than Sample A.*)

Ask students which soil sample would be the most comfortable for an earthworm to live in (*Sample B*). Ask students what this tells them about how decomposers are connected to growing our food. (*Decomposers, like earthworms, make humus. Humus in the soil makes topsoil better for growing plants [crops]. We need good topsoil in which to grow our food. Without decomposers, there would not be humus, which means that the topsoil left on Earth to grow food in would not have the right nutrients or hold enough water for plants to grow in it.*)

Step 8

Have students answer the last question on page 13 of *My Decomposition Book* on their own.

As they finish, tell students to collect the topsoil testing materials and the photo cards of **Topsoil** they used and bring them to a central place. The soils can be put back into the buckets they came from and the photo cards gathered to use in the next lesson.

Collect the students’ copies of *My Decomposition Book* to use in assessment.

Lesson Assessment

Description

This lesson teaches students that decomposers produce humus and that humus improves soil for use in agriculture. Students' work on page 12 in *My Decomposition Book* demonstrates they can identify the work of decomposers in forming humus and describe the dependence of our agricultural system on the process of decomposition.

Suggested Scoring

Use the Answer Key and Sample Answers provided on page 89–90 to assess students' work. **The Testing Topsoil** page is worth 15 points.

Answer Key and Sample Answers



Testing Topsoil

There are many types of soils. You and your partner will look at two types of soil and decide which would be best for farming.

As you look at the two soils, answer these questions:

Sample A: (1 point each)

What color is the soil? Light tan, white, grey

What does the soil feel like in your hand? Dry, loose, rough, heavy

What does the soil look like under the magnifying glass? Dry with lots of pieces that look like little rocks

What does the soil smell like? (Breathe gently.) Like sand, kind of salty and dusty

Sample B: (1 point each)

What color is the soil? Dark brown, almost black and sort of red

What does the soil feel like in your hand? Sort of wet, warm, furry, light

What does the soil look like under the magnifying glass? Like pieces of wood or chopped up wood, or mud

What does the soil smell like? (Breathe gently.) Like dirt and grass, and a little bit like manure

Circle an answer: (1 point each)

Which soil has more humus? **Sample A** **Sample B**

Which soil would be best for growing crops? **Sample A** **Sample B**

In which soil would you expect to find an earthworm? **Sample A** **Sample B**



Testing Topsoil

Think and Write:

How do we depend on decomposers in growing our food? (4 points)

Decomposers put nutrients back in the soil. When they break down matter, they create humus that is full of nutrients. The more humus soil has, the more nutrients there are. The best soil for growing crops is soil that has a lot of humus in it.

If there were no decomposers, there would be no humus. Soil without humus has fewer nutrients. We could not grow food in soil without nutrients.

Answer Key and Sample Answers

11

Topsoil

Visual Aid — Photo Cards

A photograph showing dark, rich, blackish-brown topsoil in a field. Rows of green leafy plants are visible on either side of a central path of soil. The soil appears moist and fertile.

Topsoil of the Central Valley

A photograph showing light brown, sandy, and eroded soil in a badland landscape. The soil is dry and crumbly, with visible tire tracks and deep erosion channels.

Topsoil of the Southern California Badlands